UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/943,389	08/30/2001	Sadaaki Sakamoto	P/1071-1439	8221

7590 02/04/2004

EDWARD A. MEILMAN, ESQ.
DICKSTEIN SHAPIRO MORIN & OSHINSKY LLP
1177 AVENUE OF THE AMERICAS - 41ST FLOOR
NEW YORK, NY 10036-2714

EXAMINER	
MAYES, MELVIN C	
ART UNIT	PAPER NUMBER
1734	

DATE MAILED: 02/04/2004

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	09/943,389	SAKAMOTO ET AL.	
	Examiner	Art Unit	
	Melvin Curtis Mayes	1734	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *24 November 2003*.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-18* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☒ Claim(s) *6* is/are allowed.

6)☒ Claim(s) *1-5 and 7-18* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. §§ 119 and 120

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

13)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application) since a specific reference was included in the first sentence of the specification or in an Application Data Sheet. 37 CFR 1.78.

a) ☐ The translation of the foreign language provisional application has been received.

14)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121 since a specific reference was included in the first sentence of the specification or in an Application Data Sheet. 37 CFR 1.78.

Attachment(s)

1) ☐ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s) _____.
4) ☐ Interview Summary (PTO-413) Paper No(s). _____.
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other:

DETAILED ACTION

Claim Rejections - 35 USC § 103

(1)

The text of those sections of Title 35, U.S. Code not included in this action can be found in a prior Office action.

(2)

Claims 1-5 and 7-17 are rejected under 35 U.S.C. 103(a) as being unpatentable over Hakotani et al. 5,370,759 in view of Kumar et al. 5,876,536 and Mikeska et al. 5,254,191.

Hakotani et al. disclose a method for producing a multilayered ceramic substrate for mounting and interconnecting electronic components exterior thereof comprising: forming green sheets of borosilicate glass or lead borosilicate glass and alumina; forming conductor pattern on the green sheets; stacking the green sheets; sandwiching the stacked green sheets between two inorganic material green sheets of magnesium oxide which do not sinter at the sintering temperature of the borosilicate glass of the green sheets to control shrinkage of the green sheets; and sintering in a belt furnace by heating the laminate to 900°C over one hour including a retention time of about 12 minutes at 900°C; and removing the unsintered magnesium oxide layers from the surface of the laminate (col. 1, lines 7-10, col. 5, lines 30-38, col. 10, line 50 – col. 11, line 56). Hakotani et al. do not disclose selecting sintering profile, green sheet material and inorganic material so that a reaction layer and penetration layer are formed.

Kumar et al. teach that when using a non-sintering layer to reduce shrinkage of a green tape laminate, the ceramic powder of the non-sintering layer can be either non-reactive with the ceramic and glass used to form the green tapes or interact to impart surface properties that can be

beneficial. A reactive layer having a thermal coefficient of expansion lower than that of the ceramic of the green tape laminate will increase the strength of the substrate due to compressive stress that results in the green tape surface. A reactive layer can also impart an improved surface finish to the multilayer substrate (col. 3, lines 27-38).

Mikeska et al. teach that in using a constraining layer of non-sintering ceramic to reduce shrinkage of a green tape body formed of a ceramic and glass, there is penetration of the glass into constraining layer which must be controlled so as to not exceed 50 μm to facilitate removal of the constraining layer after sintering and not adversely affect the properties of the ceramic substrate. The glass viscosity, wetting angle, etc are adjusted to control penetration. Mikeska et al. further teach that belt furnaces can be used and a typical furnace cycle which can be used to heat an assemblage of green sheets and unsinterable constraining layers comprises heating at 5°C/min to the peak temperature and maintaining the peak temperature for 30 minutes (col. 6-12).

It would have been obvious to one of ordinary skill in the art to have modified the method of Hakotani et al. for producing a multilayered ceramic substrate by sintering to cause the borosilicate glass and magnesia to react to form a reactive layer, as taught by Kumar et al, to form a reactive layer that increases the strength of the substrate and/or imparts an improved surface finish to the substrate. Controlling the sintering such that the borosilicate glass of the green sheets and the magnesia of the inorganic material green sheet react to form a reactive layer would have been obvious to one of ordinary skill in the art to impart beneficial surface properties such as compressive stress at the surface and improves surface finish, as taught by Kumar et al. By providing the green sheets of borosilicate glass and the unsinterable inorganic material green

sheets of magnesia and sintering up to 900°C over one hour (15°C/min) including a retention time of about 12 minutes at 900°C as disclosed by Hakotani et al., a borosilicate glass and magnesia are sintered at a rate of 15°C/min or less (as claimed in Claim 7) and maintained at maximum temperature for at least 10 minutes (as claimed in Claim 8 and 11) thus chemically reacting to form a crystal phase, as claimed in Claim 2, or diffusion, dissolving or solid solution of one in the other, as claimed in Claim 5.

Further it would have been obvious to one of ordinary skill in the art to have selected the borosilicate glass such that penetration of the glass into the inorganic material green sheet does not exceed 50 μm, as taught by Mikeska et al. to facilitate removal of the constraining layer (inorganic material) after sintering and not adversely affect the properties of the ceramic substrate. Selecting borosilicate glass of glass viscosity and wetting angle such that penetration is allowed but does not exceed 50 μm would have been obvious to one of ordinary skill in the to facilitate removal, as taught by Mikeska et al.

Further, it would have been obvious to one of ordinary skill in the art to have modified the method of the references as combined for making a multilayered ceramic substrate using inorganic material constraining green sheets by maintaining the peak temperature for 30 minutes, as taught by Mikeska et al., as a typical furnace cycle that can be used to heat an assemblage of green sheets and unsinterable constraining layers.

Mounting at least one electronic component on an outer surface of the multilayered ceramic substrate after firing, as claimed in Claim 14, would have been obvious to one of ordinary skill in the art, as Hakotani et al. disclose that the produced multilayered ceramic substrate is for mounting and interconnecting electronic components exterior thereof.

(3)

Claim 18 is rejected under 35 U.S.C. 103(a) as being unpatentable over the references as applied to claim 17 above, and further in view of Stoller 6,392,896.

Stoller teaches that in making semiconductor packaging, a ceramic substrate is joined to a next level of packaging, typically a motherboard, by solder elements (col. 4, lines 6-12).

It would have been obvious to one of ordinary skill in the art to have modified the multilayered ceramic substrate produced by the method of the references as combined by connecting the ceramic substrate to a motherboard, as taught by Stoller, for making semiconductor packaging.

Allowable Subject Matter

(4)

Claim 6 is allowed.

Response to Arguments

(5)

Applicant's arguments with respect to claim 1 have been considered but are moot in view of the new ground(s) of rejection.

Applicant argues that the formation of both a reaction layer and penetration layer depend on the sintering profile, the identity of the ceramic and glass of the sinterable material and the type of inorganic material and argues that the references do not teach selected the various materials and sintering profile to form a reaction layer and penetration layer.

(6)

According to Kumar et al. the formation of a reactive (reaction) layer by reaction between the non-sintering inorganic material and material of the green sheets is known to provide beneficial surface properties to a substrate and thus the formation of a reaction layer by suitable choice of inorganic material and green sheet material in the method of Hakotani et al. would have been obvious to one of ordinary skill in the art to provide the substrate with the beneficial surface properties. As taught by Mikeska et al., penetration of the glass results during sintering but this penetration should not exceed a certain level so as to facilitate removal of the non-sintered layer. Thus the formation of a reactive layer and a penetration layer are known in the art when using a non-sintering material to reduce shrinkage during sintering of a green sheet laminate.

Further Hakotani et al. disclose using borosilicate glass in the green sheets, magnesia as the non-sintering inorganic material and sintering at a rate of 900°C/hr (15°C/min) with holding at maximum temperature for 12 minutes. According to the present specification, a reaction layer is formed when the green sheets contain borosilicate glass, the non-sintering inorganic material is magnesia, the sintering rate is 15°C/min or less and the hold time at the maximum temperature is 10 minutes or more. Thus Hakotani et al. appear to disclose using a similar glass in the green sheets, similar non-sintering inorganic material and similar sintering rate and hold time as disclosed by Applicant for forming a reaction layer. Even if a reaction layer does not necessarily result from the method of Hakotani et al., the desirability of a reaction layer is set forth by Kumar et al. and one of ordinary skill in the art would have known how to modify the method to achieve a reaction layer.

Conclusion

(7)

Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

(8)

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Melvin Curtis Mayes whose telephone number is 571-272-1234. The examiner can normally be reached on Mon-Fri 7:30 AM - 4:00 PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Richard Crispino can be reached on 571-272-1226. The fax phone number for the organization where this application or proceeding is assigned is (703) 872-9306.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is 703-308-0661.

Melvin Curtis Mayes
Primary Examiner
Art Unit 1734

MCM
January 28, 2004